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CARRIER AIR WING SURGE OPERATIONS: A REVOLUTION IN STRIKE WARFARE

by

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A paper submitted to the Faculty of the Naval War College in partial satisfaction of the requirements of the Department of Joint Military Operations.

The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.

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CARRIER AIR WING SURGE OPERATIONS: A REVOLUTION IN STRIKE WARFARE

Thesis: Operational commanders will have a revolutionary new capability when Naval Aviation's Carrier Air Wing (CVW) Surge Operations concept fully matures. The synergistic effect of nuclear powered aircraft carriers, modern strike fighters, a new family of ultra precise stand-off weapons and increased sortie generation ability will create a true revolution in strike warfare. Understanding the strengths and weaknesses of surge operations, as well as its potential contribution to the operational art, will be essential if tomorrow's commanders are to employ this new capability effectively.

INTRODUCTION

CVW Surge Operations is both an innovative idea and the final piece in the puzzle to create a true revolution¹ in strike warfare. Capitalizing on Naval Aviation's investments in modern carriers, aircraft and weapons, Surge Operations will allow tomorrow's operational commanders to call on 800 devastatingly accurate strike sorties in the critical early hours of the next conflict.² The best part of this new concept is that there is nothing new to buy. CVW Surge Operations merely rethinks established carrier operating procedures in light of current ship, aircraft and weapons technology. As always, there are both strengths and weaknesses inherent in this new way of doing business. These must be fully understood before this concept can be fully utilized. Yet, one thing is clear. The potential for Naval Aviation to decisively effect the outcome of future conflicts has changed in a revolutionary way.

Critics of carrier aviation have always complained that a carrier's ability to generate strike sorties was woefully inadequate. Comparing naval aviation with sorties generated by land based strike aircraft has often yielded a wide variety of statistics, mostly

owing to the color of the uniform you're wearing. It should come as no surprise that 500 aircraft operating from several million square feet of ramp space ashore, can produce more strike sorties than one tenth that number operating from four acres at sea. The object of this paper is not to debate the land-based / sea-based issue. Numerous Center for Naval Analysis and RAND studies have done so (exhaustively) in the past.³ It bears mentioning, up front, only because so many papers that discuss surge or sortie generation rates degenerate into comparisons on USAF verse Navy capabilities. This one will not. CVW Surge Operations is a tool for the operational commander to use in the very early hours of a conflict, or whenever large numbers of strike sorties are required.⁴ It does not purport to replace the need for land-based tactical aircraft (tacair). Surge Operations merely allows Naval Aviation to expend maximum effort for a brief period of time, usually no more than 96 hours. The revolution is in what can be accomplished in those four short days. A single forward deployed carrier may be able to halt the invasion, or retake the initiative, and allow time for follow-on forces to flow into theater.

SURGE OPERATIONS: What is it and how is it possible

The most famous master of war, Carl Von Clausewitz has said "everything in war is very simple, but the simplest thing is difficult."⁵ Although the nuclear powered aircraft carrier (CVN) and modern strike fighter were 150 years in the future, he could have been referring to CVW surge operations. The concept of Surge Operations is relatively simple. A single CVN produces 10 sorties an hour, around the clock, or 240 sorties per day. 200

of these are strike sorties flown by F/A-18 Hornets, F-14 Tomcats and HARM⁶ equipped EA-6B Prowlers. The remaining 40 are flown by E-2's, S-3B's and helicopters flying airborne early warning,⁷ anti-submarine, anti-surface and other missions vital to force protection. The concept is simple, but the execution, due to a myriad of factors, is much more challenging. A discussion of those factors will be addressed later in this paper.

The previous maximum number of sorties an aircraft carrier could produce in a single day was 166.⁸ This was considered the maximum due to cycle time,⁹ a product of the time it took to turn aircraft around. This includes time spent on maintenance, refueling, rearming and re-spotting the aircraft for the next launch. The addition of 74 sorties a day represents a significant 45% increase in sorties generated. What has changed that allows Naval Aviation to take such a quantum leap in sortie generation? As was noted earlier, surge operations is but one piece in Naval Aviation's Revolution in Strike Warfare. The other important pieces are nuclear powered aircraft carriers, modern strike fighters and a family of new precision weapons. Taken together they remove many of the obstacles that prevented more aggressive utilization of naval aircraft.

The nuclear powered aircraft carrier carries twice as much jet fuel as does its conventionally powered counterpart.¹⁰ Add a larger deck and half again the weapons capacity and you have much more of the three things that are used up quickly when you fly sorties around the clock.¹¹ It's useless to produce 800 strike sorties if you run out of ordnance after 500. Another thing in short supply during around the clock operations is

time to maintain aircraft. With the relatively new F/A-18 accounting for 36 of the 50 strike fighters on your deck, you simply spend far fewer hours maintaining aircraft and providing for time killing re-spots and elevator runs. Finally, the weapons you are loading are far fewer but much more accurate and deadly. Where we previously had A-7's and A-6's carrying enormous iron bomb loads, today's self-escorting strike fighter carries a notional load of four precision guided munitions. When the Joint Stand-Off Weapon (JSOW) and Joint Direct Attack Munition (JDAM) are introduced in fiscal years 1998 and 1999 respectively, Naval Aviation will have gone from "flying multiple sorties per aimpoint killed, to multiple aimpoints killed per sortie."¹² JDAM and JSOW are Global Positioning System guided weapons, which will give Naval Aviation true all-weather capability. In sophisticated defensive environments, JSOW will allow several targets to be engaged from a single release point outside many of the enemy's surface to air missile envelopes. By increasing sorties by as much as 45%, Surge Operations has a multiplying effect when added to the aforementioned investments in Naval Aviation. This order of magnitude increase in capability will require our operational commanders to rethink Naval Aviation's contribution to the operational art.

CONTRIBUTION TO OPERATIONAL ART

The Principles of War Apply

"Sun Tzu's *The Art of War* is the first known attempt to formulate a rational basis for the planning and conduct of military operations."¹³ Its timeless passages, written more than 2000 years ago, summarize those conditions necessary to achieve success in combat

operations. Over the past two millennia we have distilled the essence of Sun Tzu's work into the nine principles of war.¹⁴ Today, the principles of war permeate many modern doctrinal publications including FMFM 1 *Warfighting*, FM 100-5 *Operations*, Joint Pub 3-0 *Joint Operations* and most recently Naval Doctrine Publication 1, *Naval Warfare*. The principles of war are a good place to start when evaluating the contribution of a new concept such as CVW Surge Operations.

Objective: Direct every military operation toward a clearly defined, decisive, and attainable objective.¹⁵

“The objective is unquestionably the most important of all the principles of war.”¹⁶ The most brilliant use of CVW Surge Operations will be useless if, in the final analysis, it does not contribute to the strategic objective. Although committing 800 combat sorties is something that will most likely be given serious consideration, the use of Surge Operations should be carefully evaluated in light of both the strategic and operational objective. A key element in determining the objective is that it must be attainable with available forces. Surge Operations is, by definition, an all out effort and will not be appropriate for all situations. The most important “take away” for the operational commander is to articulate a clearly stated objective, and allow subordinate commanders to use Surge Operations to link their actions to the objective and focus on execution.

Offensive: Seize, retain and exploit the initiative.

“Offensive action is the most effective and decisive way to attain a clearly defined common objective.”¹⁷ And there is no more potent, offensive weapon of war than a United States nuclear powered aircraft carrier.¹⁸ Designed with offensive operations in mind, a forward deployed CVN is just the ticket operational commanders are looking for when they want to seize and retain the initiative. These days however, offensive combat operations will more than likely be in response to an overt act of aggression. The initiative may be with our opponent in the early stages of conflict; one whose goal is to dictate the terms of combat to us. “Initiative is a highly contested quality whose balance swings on surprise, deception, speed of action, ingenuity and asymmetric comprehension.”¹⁹ Surge Operations clearly addresses these five attributes with four days of unrelenting strikes, that can produce a tempo of operations that can force an adversary to become defensive and reactive.

Mass: Mass the effects of overwhelming combat power at the decisive place and time.

Clausewitz tells us that “there is no higher and simpler law of strategy than that of keeping one’s forces concentrated...to be very strong; first in general and then at the decisive point.”²⁰ Desert Storm is a recent example of the massing of over 500,000 coalition forces in an effort, that succeeded in part, because of a cooperative adversary. In the future, our operational commanders may not face such a cooperative adversary, or due to the recent drawdown, may not have the forces available to enter a conflict with a

quantitative advantage. CVW Surge Operations, when employed in concert with Tomahawk Land Attack Missiles (TLAM) and superior reconnaissance and surveillance, will allow commanders to “mass effects, rather than concentrating forces, enabling numerically inferior forces to achieve decisive results, while limiting exposure to enemy fire.”²¹

Maneuver: Place the enemy in a position of disadvantage through the flexible application of combat power.

Air power is the most flexible weapon in existence. Yet, “it is only when air power is wedded to free moving sea power that it achieves true mobility.”²² The aircraft carrier is therefore the ultimate weapon in maneuver warfare. With an air wing capable of 200 strike sorties per day, the carrier can provide the operational commander with the means to apply combat power faster than an adversary can react. Higher sortie generation rates combined with the increased ranges, accuracy and lethality of modern weapons compresses time and space and creates a tempo of operations that will be difficult for our adversaries to match.²³ CVW Surge Operations will represent a single and readily available source of operational mobility, capable of attacking the enemy’s depth even before his tactical defenses have been penetrated.

Surprise: Strike the enemy at a time or place or in a manner for which he is unprepared.

True surprise is difficult to achieve in today's world of modern surveillance satellites and mass communications. An American aircraft carrier operating in the littoral of a potential enemy is not something he is likely to miss. There are however, several factors that can contribute to the surprise achieved from a highly visible force such as a carrier battle group (CVBG). The most important of these are unexpected combat power and tempo of operations. A carrier air wing executing the Surge concept will be able to surprise a future enemy with the intensity and accuracy of strike operations. By engaging and destroying far more targets than the enemy thought possible, future operational commanders may gain an early advantage that the enemy will find impossible to regain.

Operational Fires

“The purpose of operational fires is to accomplish operational objectives in support of a major operation or campaign.”²⁴ This is generally achieved by hitting targets outside an area in which a major operation or campaign is to be conducted. The 38 days of strikes deep into the heart of Iraq and Kuwait, during the first phase of the Gulf War, represent a classic example of operational fires. Tactical fires, on the other hand, are confined within a given area of operations. Historically, it has not been unusual for the same platform to participate in both operational and tactical fires. Naval Aviation has played a role in both. As technology increases the ranges of strike aircraft, and weapons become more accurate and destructive, it becomes apparent that tactical aviation will play an ever increasing role in operational fires. Therefore, it is prudent to examine how naval tactical aviation will shape the future battlespace in light of these technological advances.

of gravity or stockpiles of Weapons of Mass Destruction (WMD). Unlike interdiction, which would be in support of friendly forces and invariably involve joint forces, these actions do not depend on other concurrent actions to be successful. This type of operational fire is especially attractive in an immature or undeveloped theater, where the lack of forces and assets may preclude a major offensive operation by U.S. or coalition forces.²⁷ Herein lies the inherent flexibility and versatility of a carrier battle group. Forward deployed with its logistics train already in place, it has the capability to effect the outcome of a crisis immediately. In future scenarios, political pressures may delay the decision to deploy U.S. based forces. The operational commander may have to handle the crisis, at least initially, whether follow-on forces are forthcoming or not, with the assets he has on hand. Operational fires that neutralize or substantially degrade enemy operational capabilities may force a potential adversary to re-think his present course of action and obviate the need for follow-on forces. If an adversary is hell bent on full blown confrontation, the same Navy tacair can shift to interdiction type operational fires and pave the way for follow-on forces. Regardless, the fact of the matter is that the carrier and its battle group can be, and often times is, the only source of operational fires available to the commander.

The CVW Surge Concept gives the carrier battle group the capability to positively effect the outcome of future crises. Forward deployed, it will have a far greater ability to strike at the heart of potential adversaries with operational fires that cripple his ability to continue with further aggression and convince him of U.S. commitment and resolve. The

CVW Surge concept takes full advantage of advances in technology and when its increased sortie generation capability is married up with JDAM and JSOW,²⁸ the operational commander will possess an unrivaled ability to conduct operational fires.

The Center of Gravity

CVW Surge Operations will no doubt have an effect on the enemy's center of gravity. With increased capability to fly strikes and hit with devastating accuracy, Surge Operations can attack and contribute to the destruction of the hub of the enemy's power and strength. The question is, how will Surge Operations change our center of gravity?

There are different centers of gravity and they are capable of changing over time. The strategic center of gravity rarely changes in the course of a conflict. The strategic center of gravity is derived from the nation's dominant characteristics which evolves over many years.²⁹ In the Vietnam War, the United States' strategic center of gravity was the will of the American people. The North Vietnamese leadership understood this, and although they were out gunned at every level of warfare, they were ultimately successful. As was the case in the Vietnam war, the strategic center of gravity rarely changes, even throughout the course of an extremely protracted conflict.

This is not true at the operational level of war. The center of gravity changes as the conflict progresses through the various phases of major operations and campaigns. Desert Shield and Desert Storm offer a fine case in point. Initially the U.S. center of

gravity was the carriers in the Gulf of Oman and the Red Sea. As a lodgment was established and a preponderance of forces were located ashore, the center of gravity shifted to the ground forces as they had become the hub of power and movement. As Surge Operations greatly expands the ability of Naval Aviation to shape events, the carrier and its associated battle group will represent a center of gravity that shifts to ground forces ashore much later than previous experience suggests. This is significant in that most regional adversaries find it more difficult to attack a center of gravity at sea than they do ashore. Using either of our current Major Regional Conflict scenarios as an example will illustrate this point. Both North Korean and Iraqi doctrine call for large standing armies and the destructive capabilities of WMD. Their air forces and naval power are simply no match compared to the size and technological superiority of U.S. forces. Yet, a powerful air force and navy, including modern submarines, is exactly what is required if you hope to penetrate the defenses of a carrier battle group. True, the CVBG is vulnerable to WMD, but anyone will agree that the carrier is far more difficult to target and attack than airfields and troop concentrations ashore. The CVBG can rapidly shift position before, during and after an attack. Large concentrations of troops and equipment, as well as installations ashore, are repositioned much more slowly and with greater effort. Additionally, any weapon thrown at the battle group must run the gauntlet of sophisticated defenses that is inherent in any CVBG.

As stated in a previous paragraph, the strategic center of gravity for the U.S., has been, and still is, the will of the American people. Only for the most severe threats to our

national security, or when U.S. forces have the backing and legitimacy of the UN and a large coalition, will the American public be willing to commit large ground forces. With the specter of additional force reductions once the QDR is completed, we may soon be both less willing and less able to deploy large forces to hot spots overseas. What this means is that our naval forces will be our center of gravity for a much longer period of time. Advanced thinking in both the Army and Marine Corps has considered the use of far smaller forces ashore in future conflicts, calling on directed fires... from the sea. There may even be some future scenarios where the center of gravity never shifts to the forces ashore. All these factors need to be considered when planning major operations, as well as future force structure. Naval Aviation Surge Operations may change the calculus of future conflicts.

SURGE OPERATIONS: Executing the Concept

The Surge Operations concept still needs to answer several questions before we can start generating maximum sorties from our deployed carriers effectively. Probably the most important question to answer is when to execute Surge Operations, or more correctly, how to execute the concept appropriately. A look at two different scenarios will illustrate when and how Surge Operations should be employed.

If there are 1000 tanks and trucks dug in along defensive positions waiting for U.S. forces to attack, a case can be made for using Surge Operations to heavily attrite this force. This would be similar to the scenario in the Gulf War when Iraqi forces deployed

defensively in Kuwait. If these same 1000 tanks and trucks are on the move in various parts of the area of operations, then perhaps indiscriminate “tank plinking” by Navy tacair would not be appropriate. The difference between static and maneuver warfare is extremely important to understand when evaluating the effectiveness of a high sortie generation capability. In static warfare, targets are virtually infinite in number and, generally speaking, undifferentiated as to their importance.³⁰ A good Measure Of Effectiveness (MOE) in this type of environment is total number of targets destroyed. The ability to generate maximum sorties is therefore relevant in this situation.

In maneuver warfare, a target rich environment may not be a relevant criterion for the use of a high sortie generation capability such as Surge Operations.³¹ In the case of our 1000 tanks and trucks, it may be more important to kill fifty vehicles in the right place, right now, than 200 somewhere else. Instead of around the clock surge operations, a more traditional 25 plane strike on a 2+30 (double) cycle could be more effective. A MOE of total vehicles destroyed is not appropriate in maneuver warfare. The correct measure of effectiveness in maneuver warfare is operational results. This is obtained by all force elements (sea, ground and air) not a single element. “Thus, efficiency and effectiveness are not synonymous in attrition and maneuver warfare.”³² I can envisage Naval Aviation participating in both type scenarios. The key is to understand the difference.

There are several other questions that need to be addressed, some of which could be answered this summer on the second USS Nimitz Surge exercise. This will be a full 96 hour exercise vice the 48 hour demonstration conducted last summer. It will seek to nail down exact requirements for crew augmentation. Our modern strike fighters are capable of operating around the clock without rest. Unfortunately, that's not true for our aircrews or deck, tower, ordnance and bridge personnel. It appears that approximately 20 aircrew and no more than 80 ship's company will be required for a 96 hour surge.³³ These critical individuals will more than likely come from returning battle groups as they will be current with all phases of shipboard operations. The big question to be answered is how do you get 100 people to a forward deployed carrier quickly. In many of the situations likely to require Surge Ops, the warning time may be very short. Once these augmentation personnel leave the West coast, for example, they are looking at crossing many time zones and a major case of jet lag. Planning and flying a potentially high tempo combat mission soon after being suddenly alerted to surge, may leave aircrews both mentally and physically behind the power curve. One solution may be to have Air Force Transportation Command dedicate a flight directly to the area of operations with a departure time coordinated to minimize the effects of jet lag. Once in theater, it will take at least 4, probably 5, C-2 flights to get everyone and their gear aboard the carrier. Some may ask if there is an airfield ashore capable of landing a transport aircraft, why can't the Air Force deploy and bring their considerable sortie generation capability to bear. Certainly they can if the time and need arise. In many situations the host nation may be unwilling to allow large combat forces to deploy and station themselves on their soil. One hundred people

who arrive and depart on another airplane that same day, will not be seen as an escalation in the potential conflict or be as hard to get host nation support for. To be effective though, these 100 people must be aboard the carrier inside the time it takes the Air Force to deploy a tactical fighter wing. This appears to be one of the more urgent problems to solve prior to executing an effective surge operation.

Another area that needs to be addressed is the air plan and flight crew scheduling. When you develop a concept like Surge Operations, that by its very nature calls for all out effort and efficiency, you run into a problem called the “cascade effect.”³⁴ If a pilot and plane divert to a shore based field due to an aircraft malfunction or combat damage, will the schedule fold like a house of cards? Perhaps the schedule can handle the loss of 1 or 2 planes and pilots in the later stages of a 96 hour Surge, but what if 4 or 5 F/A-18’s are lost in the first 24 hours. Add to that crew rest times, watch requirements, Landing Signal Officer duties and more than a couple of flight crew medically down and this “web of time and motion”³⁵ can unravel in a matter of hours. As the system puts greater demands on each plane and pilot, even minor disturbances can send shock waves through the schedule that can cascade for days. Sidelining aircraft and aircrews as spares would help to fill holes left in the schedule by unforeseen events, but that only reduces your capability to mount an all out effort. One solution may be to have spare aircraft either on board or ashore at your nearest divert field. Unfortunately, if the aircraft are not already there when the shooting starts, they will probably not make a difference during a 4 day Surge. Pilots that end up ashore could leave their aircraft and return via the embarked helicopter

prior to their next event, thus preserving the schedule. One thing is clear, this “paradox of efficiency”³⁶ is something that will require serious attention if Surge Operations is to be successful.

CONCLUSION

Carrier Air Wing Surge Operations is the right concept at the right time. Capitalizing on previous investments in Naval Aviation, Surge Operations combines innovative thinking with today’s technology to achieve results that far exceed the sum of its individual parts. Facing an ever decreasing budget, Naval Aviation leadership has endeavored to wring every ounce of performance and efficiency from available forces. With the CVW Surge Concept, they have achieved success and for that they deserve much credit. As with any new concept or weapons system, we must first understand it completely, then learn to employ it correctly. Serious questions and problems must be addressed in detail as the concept matures. Our operational commanders must see Surge Operations for what it truly is and use it to best effect. Surge Operations is not a panacea or a silver bullet. It is but another tool to call on when maximum effort is required from what may constitute limited forces on hand. When fully mature, Surge Operations will undoubtedly effect the execution of operational art in future conflicts. This paper has only touched on the highlights in an attempt to offer food for additional thought. In the long run we must recognize that the “Revolution in Strike Warfare” only indicates the direction in which we are heading.³⁷ Surge Operations may merely provide a glimpse of the future landscape of war.

Endnotes

¹ The term revolution in strike warfare is attributed to then RADM Brent Bennett in 1995 when he was Director, Air Warfare (N88). A true RMA, as defined by David S. Yost in the Summer 1995 Joint Force Quarterly, "requires the combination of advanced weapons systems and associated systems based on new technologies, innovative operational concepts, and astute organizational adaptations. The result of such a revolution is a basic change in the character of operations, with substantially increased combat effectiveness." CVW Surge Operations clearly meets these criteria.

² Transcript of interview with VADM Brent Bennett, COMNAVAIRPAC, by Mr. Rob Holzer, Defense News, 3 February 1997. Transcript provided by LTJG Charles Brown, COMNAVAIRPAC, PAO.

³ The most widely read of these are David A. Perin, Some Observations on the Sortie Rates of Land-Based and Sea-based Tactical Aircraft (Alexandria, VA: Center for Naval Analyses 1995) and Christopher Bowie and others, The New Calculus (Santa Monica, CA: RAND 1993)

⁴ In the past Naval Aviation has surged for 1-2 days and produced nearly as many sorties as this concept. There are two important differences when comparing previous efforts with today's. First, aircraft today require far less maintenance than did aircraft in the 70's and 80's. The previous surge limit of 1-2 days was aircraft limited. Today's 4 day limit is personnel driven, illustrating the advances in aircraft maintainability. Finally, max sorties flown in the 70's and 80's did not produce the effect that today's modern strike fighters produce when coupled with advanced weapons.

⁵ Carl Von Clausewitz, On War ed. Michael Howard and Peter Paret (New Jersey: Princeton University Press, 1984), 119

⁶ Highspeed Anti-Radiation Missile

⁷ Anti-air is provided by Aegis capable cruisers and destroyers and the Cooperative Engagement Capability (CEC)

⁸ Chief of Naval Operations, Director of Air Warfare (N88), Carrier Sortie Generation Capability, N88 Memo to N8 (Washington, DC: 27 September 1994), 1.

⁹ The previous standard aircraft carrier mode of operation was 8 cycles of 1 hour and 45 minutes (1+45) each per day. This equaled a 14 hour "flying day." With the introduction of the F/A-18 the standard cycle varies from 1+15 to 1+45 depending on mission and environment. Due to manpower constraints a carrier can only operate around the clock for limited periods of time.

¹⁰ RADM Dennis V. McGinn, Director Air Warfare (N88), "Carrier Surge Operations" Laptop Brief to the office of the Secretary of Defense, Washington DC: 1 March 1997, slide 4

¹¹ Ibid.

¹² Brent M. Bennett, "The State of Naval Aviation," Naval Aviation News, November-December 1995, 1

¹³ Sun Tzu, The Art of War, trans. Samuel B. Griffith, (New York: Oxford University Press, 1971) Back cover

¹⁴ The nine principles of war according to U.S. Army FM 100-5 are Objective, Offensive, Mass, Economy of Force, Maneuver, Unity of command, Security, Surprise and Simplicity

¹⁵ The definition of this and succeeding principles of war are taken from U.S. Army, FM 100-5, Operations, (Washington, DC: US Government Printing Office, 1993), 2-4

¹⁶ C. R. Brown, "The Principles of War," U.S. Naval Institute Proceedings, June 1949, 624

¹⁷ FM 100-5, Operations, 2-4

¹⁸ Some may contend that a Trident submarine with 24 D-5 missiles represents a more potent offensive weapon. While the author will not argue with the Trident's overall firepower it is not a weapon system that is likely to be used in any scenario short of responding to global nuclear war.

¹⁹ Robert W. Riscassi, "Principles for Coalition Warfare," Joint Force Quarterly, Summer 1993, 61

²⁰ Clausewitz, 204

²¹ FM 100-5, Operations, 2-5

²² Brown, 629

²³ Riscassi, 61

²⁴ Joint Military Operations Department, "Operational Functions," unpublished student hand-out (NWC 4103) for the Naval War College, Newport, RI, August, 1996, 24

²⁵ Patrick S. Collins, "Fires from the Sea: The Carrier Battle Group as a Source of Operational Fires," unpublished research paper, U.S. Naval War College, Newport, RI: 1996, 5.

²⁶ Joint Pub 3-0, Doctrine for Joint Operations, (Washington, DC: CJCS, 1 February 1995), GL-7

²⁷ Joint Military Operations Department, "Operational Functions," 28

²⁸ Other systems that add to the synergistic effect of increased sorties and advanced weapons include Aegis and CEC, EA-6B ICAP III, and TLAM Block III

²⁹ Bruce L. Kidder, "Center of Gravity: Dispelling the Myths," unpublished research paper, U.S. Army War College, Carlisle Barracks, PA: April 1996, 15

³⁰ Martin van Creveld, Air Power and Maneuver Warfare (Maxwell Air Force Base, Alabama: Air University Press, 1994), 204

³¹ *Ibid.*

³² *Ibid.*

³³ Transcript of interview with VADM Brent Bennett, COMNAVAIRPAC, by Mr. Rob Holzer, Defense News, 3 February 1997.

³⁴ James Gleick, "Flight Control," New York Times Magazine, 20 April 1997, 24

³⁵ *Ibid.*

³⁶ *Ibid.*

³⁷ Gary W. Anderson, "Leaving the Technocratic Tunnel," Joint Force Quarterly, Winter 1995-96, 75

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